Homework: Arc Length and Center of Mass

Calculus II, Math 112

Name:_____

1. Find the arc length of the curve for each of the following. Compute each integral by hand!

(a) $y = \frac{1}{3}(x^2 + 2x)^{3/2}$ between $x = 0$ and $x = 1$.

(b) $y = \frac{x^4}{4} + \frac{1}{8x^2}$ between the points $(1, \frac{3}{8})$ and $(3, \frac{1459}{72})$.

(c) $y = \ln(\sec(x))$ over the interval $\left[0, \frac{\pi}{4}\right]$.

2. The masses m_i are located at the points P_i. Find the moments M_x and M_y and the center of mass of the system $(\bar{x}, \bar{y})$.
$m_1 = 6, m_2 = 5, m_3 = 1, m_4 = 4$.
$P_1 = (1, -2), P_2 = (3, 4), P_3 = (-3, -7), P_4 = (6, -1)$.

3. Sketch the region bounded by the curves, and visually estimate the location of the centroid. Then find the exact coordinates of the centroid. You may use Maple to compute the integrals for these problems.

(a) $y = \sqrt{x}, y = 0, x = 9$.

(b) $y = \frac{1}{x}, y = 0, x = 1, x = 2$.

(c) $y = \sin(x), y = \cos(x), x = 0, x = \frac{\pi}{4}$.

(d) $y = x, y = \frac{1}{x}, y = 0, x = 2$.